

# **W76-1/Mk4A Performance Requirements**

## **II. 6.0 Establishing and Validating Requirements**

***[Our primary mission is to ensure that the Nuclear Weapons Stockpile is safe, secure, and reliable and fully capable of supporting our Nation's deterrence policy.]***

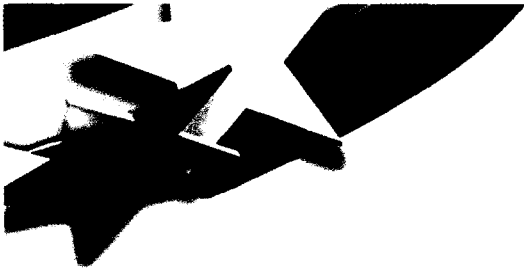
**DOE-AL QAS 1.0**  
**Tuesday, August 29, 2000**

**Mark A. Rosenthal**  
**W76-1 Life Extension Project Manager, 2114**



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,  
for the United States Department of Energy under contract DE-AC04-94AL85000.





# Outline

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- **W76-1/Mk4A Project**
- **Requirements and Business Practices**
- **Establish Requirements**
- **Validate Requirements**
- **Status**



## **W76-1/Mk4A Life Extension Project**

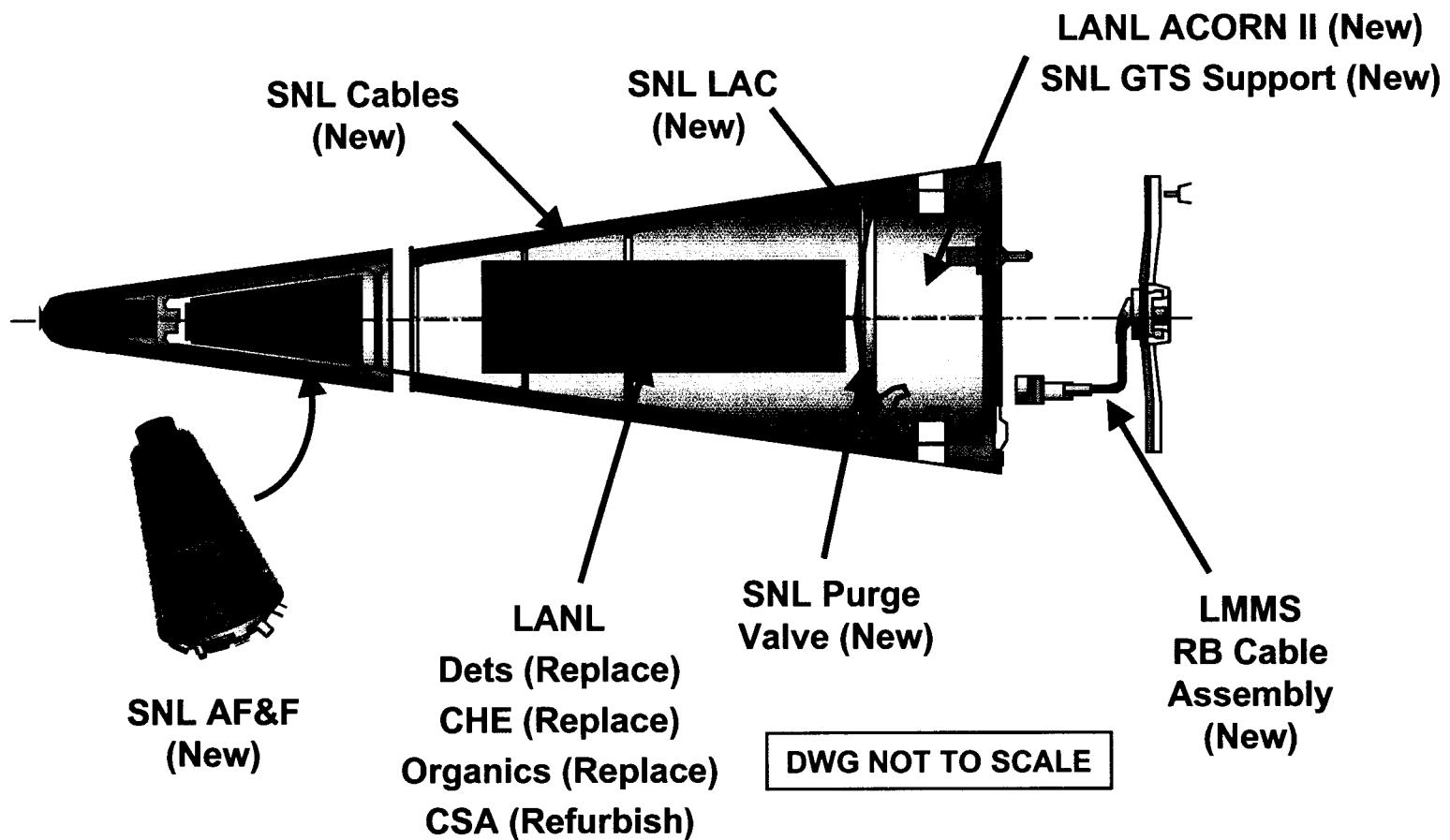
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**Extend the life of the W76/Mk4 by 30 years,  
with an FPU of Sep 2007 for the W76-1/Mk4A**

- **Nuclear Weapons Council Standing and Safety Committee (NWCSSC) authorized Phase 6.2/2A Study on 8/8/98**
- **Joint DoD/DOE Phase 6.2/2A Study initiated 10/19/98**
- **Developed Phase 6.2 warhead design options (2/2/00) and Phase 6.2A cost estimates (4/12/00) for a refurbished W76-1/Mk4A**
- **W76-1 Phase 6.2/6.2A Study Results Briefed to NWCSSC 12/8/99**
- **NWC approved entry into Phase 6.3 on 3/13/99**
- **W76-1 Phase 6.3 DoD/DOE Kickoff on 7/19/00**

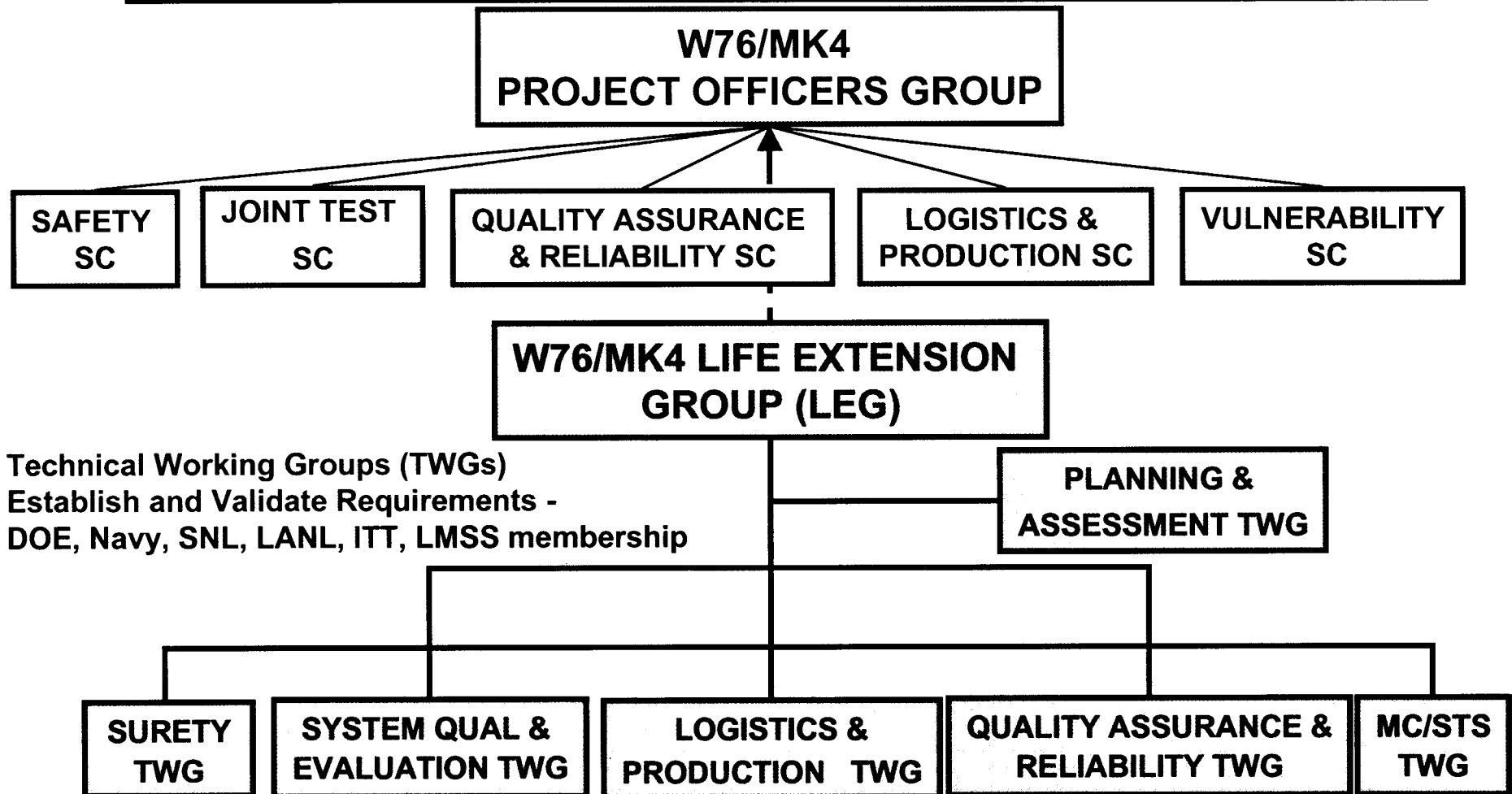


# W76-1/Mk4A Life Extension



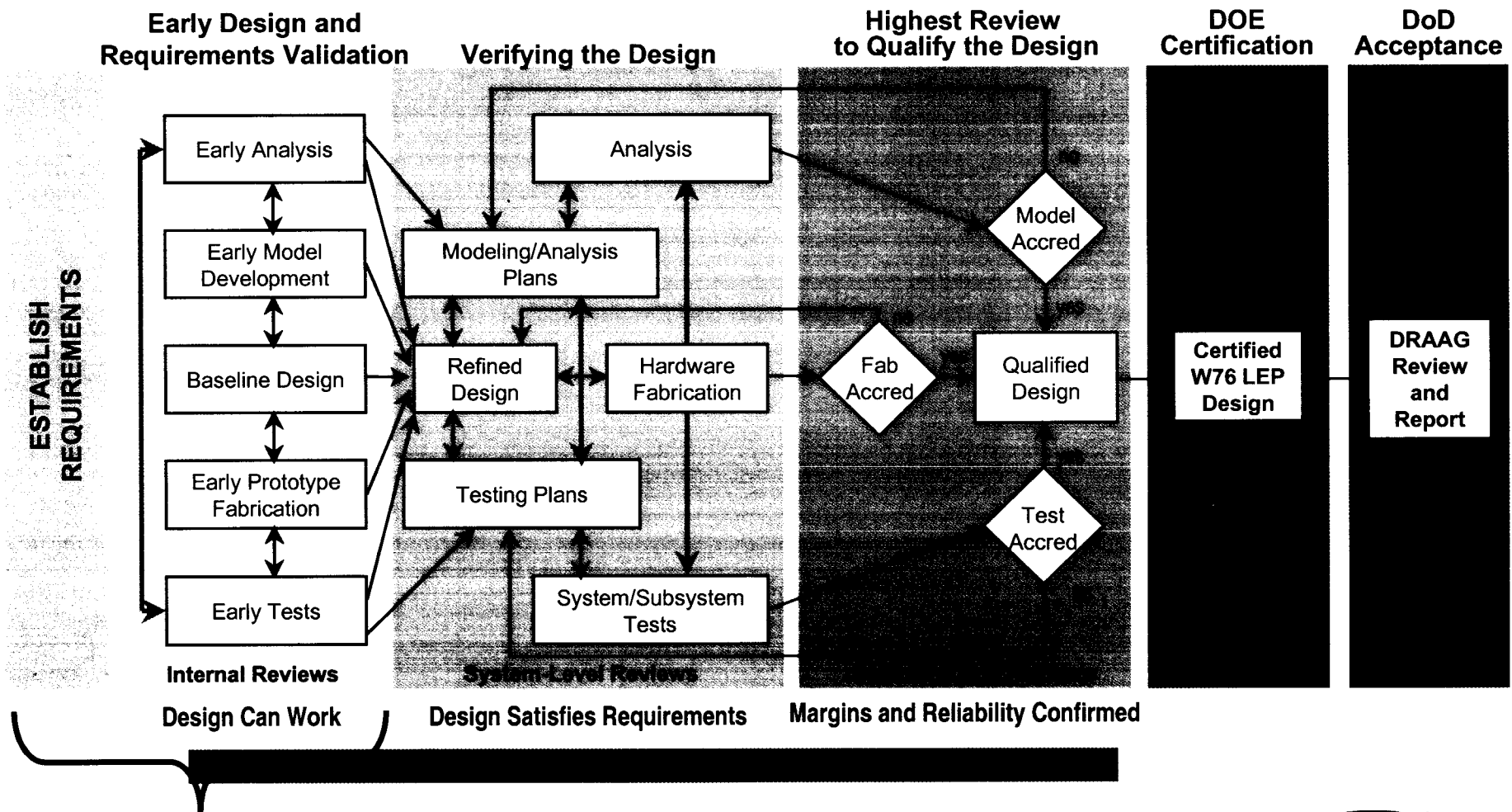
# W76/MK4 LIFE EXTENSION PROGRAM

## DoD Organizational Structure





# System Qualification Strategy



**Performance Requirements Established and Validated**



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# **DoD System-Level Performance Requirements**

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- **Military Characteristics (MCs)**
  - DoD document defining DOE weapon performance and interface requirements
- **Stockpile-to-Target Sequence (STS)**
  - DoD document defining weapon normal, abnormal and hostile environments for transportation, storage, deployment and delivery
- **Interface Control Drawings (ICDs)**
  - DoD drawings defining DoD/DOE functional and physical interfaces
- **Weapon Specifications (WS)**
  - DoD documents defining specific functional requirements





# **Sandia Internal Performance Requirements**

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- **Environmental Specification (ES)**
  - Converts STS into component environmental requirements
- **Compatibility Definition (CD)**
  - Specifies component physical and functional interface requirements
- **Mechanical Envelope (ME)**
  - Graphically defines component physical interfaces
- **Nuclear Safety Specification (NS)**
  - Specifies nuclear safety design architecture and implementation

**Input requirements to the component designers**



## **DOE Technical Business Practices (TBPs)**

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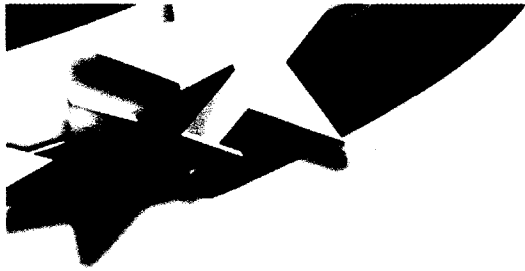
- **TBP-000, Program Management**
  - Establishes MCs and STS requirements documents relative to product realization process
- **TBP-100, Concurrent Qualification**
  - Ensures that product requirements are validated and documented in a concurrent engineering environment
- **TBP-301, Methods of Definition**
  - Establishes a system of engineering specifications that include ES, CD, ME and NS documents



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## **W76-1/Mk4A**

### **Establish Requirements**

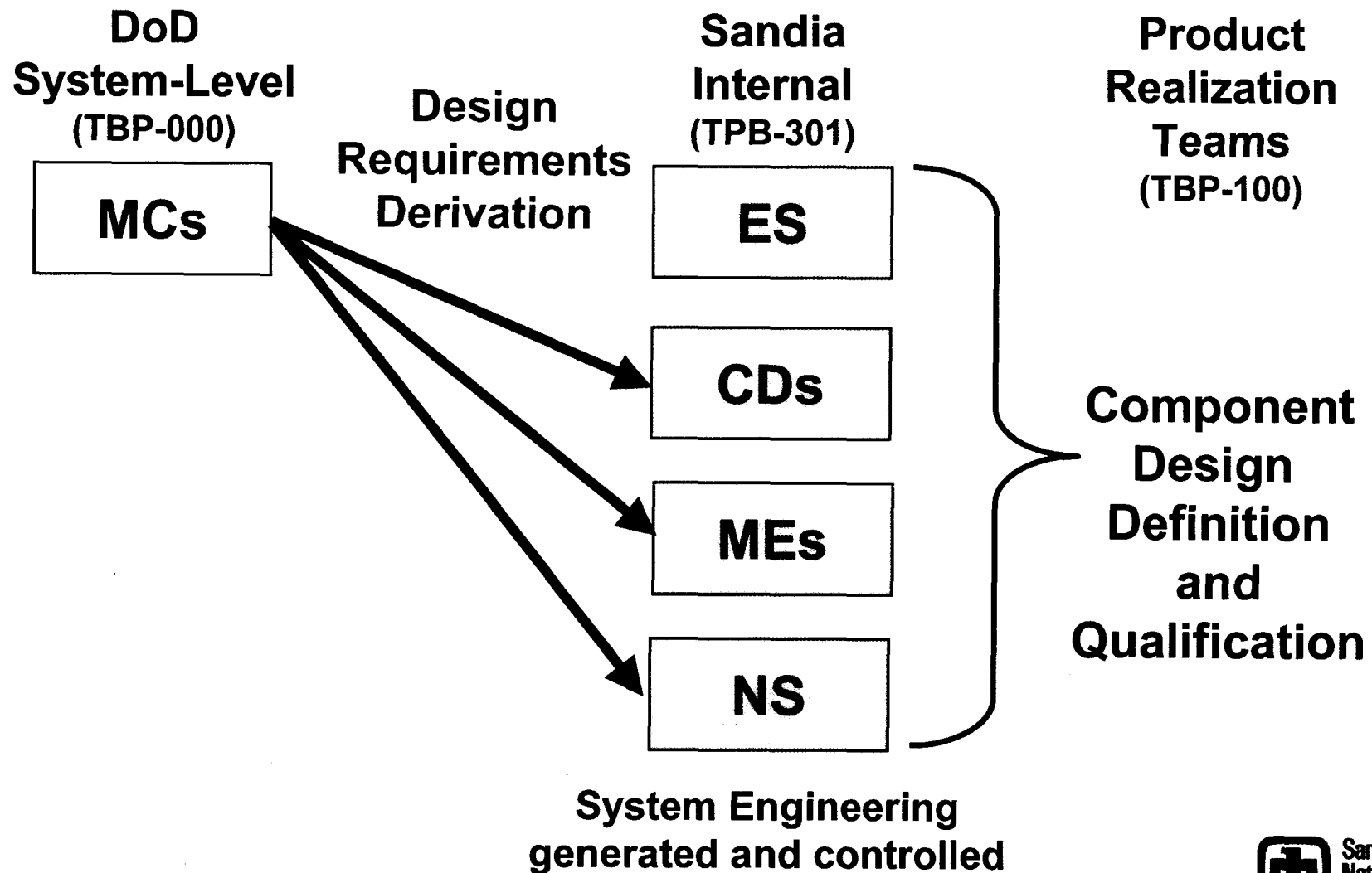
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- **Design Integration and Certification Technical Working Group (DI&C TWG) established draft requirements during Phase 6.2/2A**
  - **MCs - based on W76-0/Mk4**
  - **STS - based on W76-0/Mk4 and W88/Mk5**
  - **ICD - based on W88/Mk5 (D5 missile)**
  - **WS - based on W88/Mk5**
- **MCs/STS Technical Working Group will revise and release system requirements during Phase 6.3**

**ESTABLISH  
REQUIREMENTS**

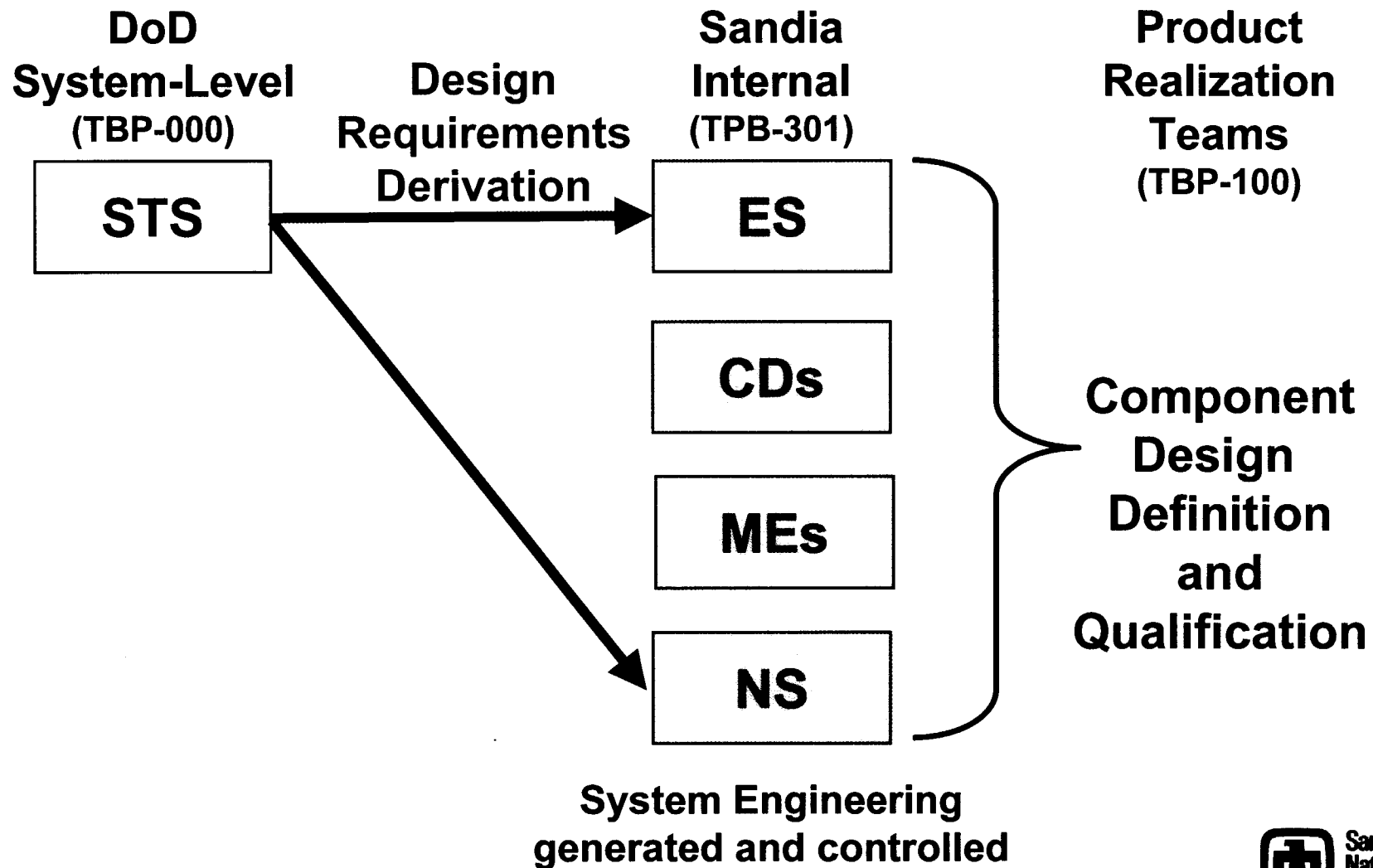


# MCs Requirements Flow Process



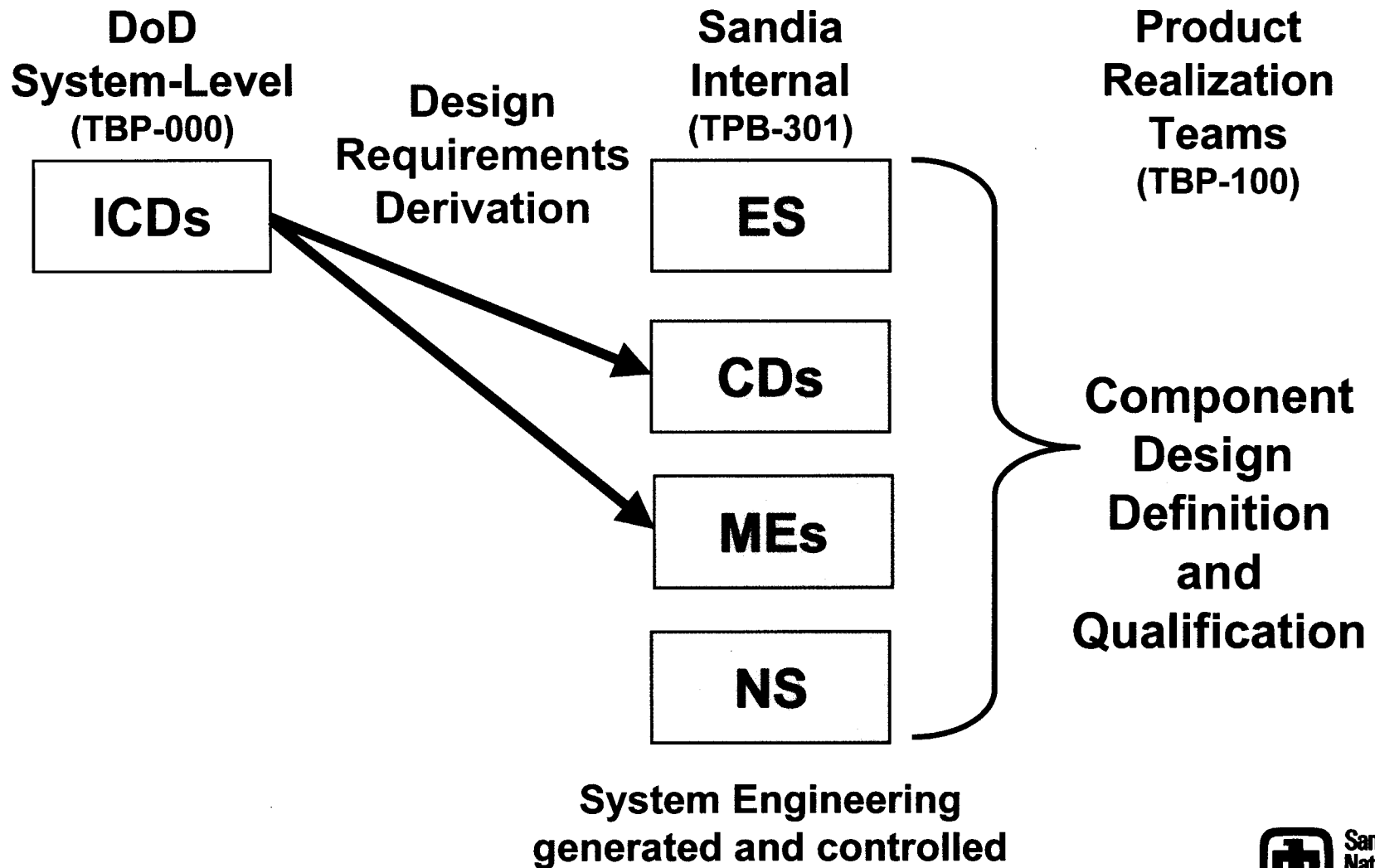


# STS Requirements Flow Process



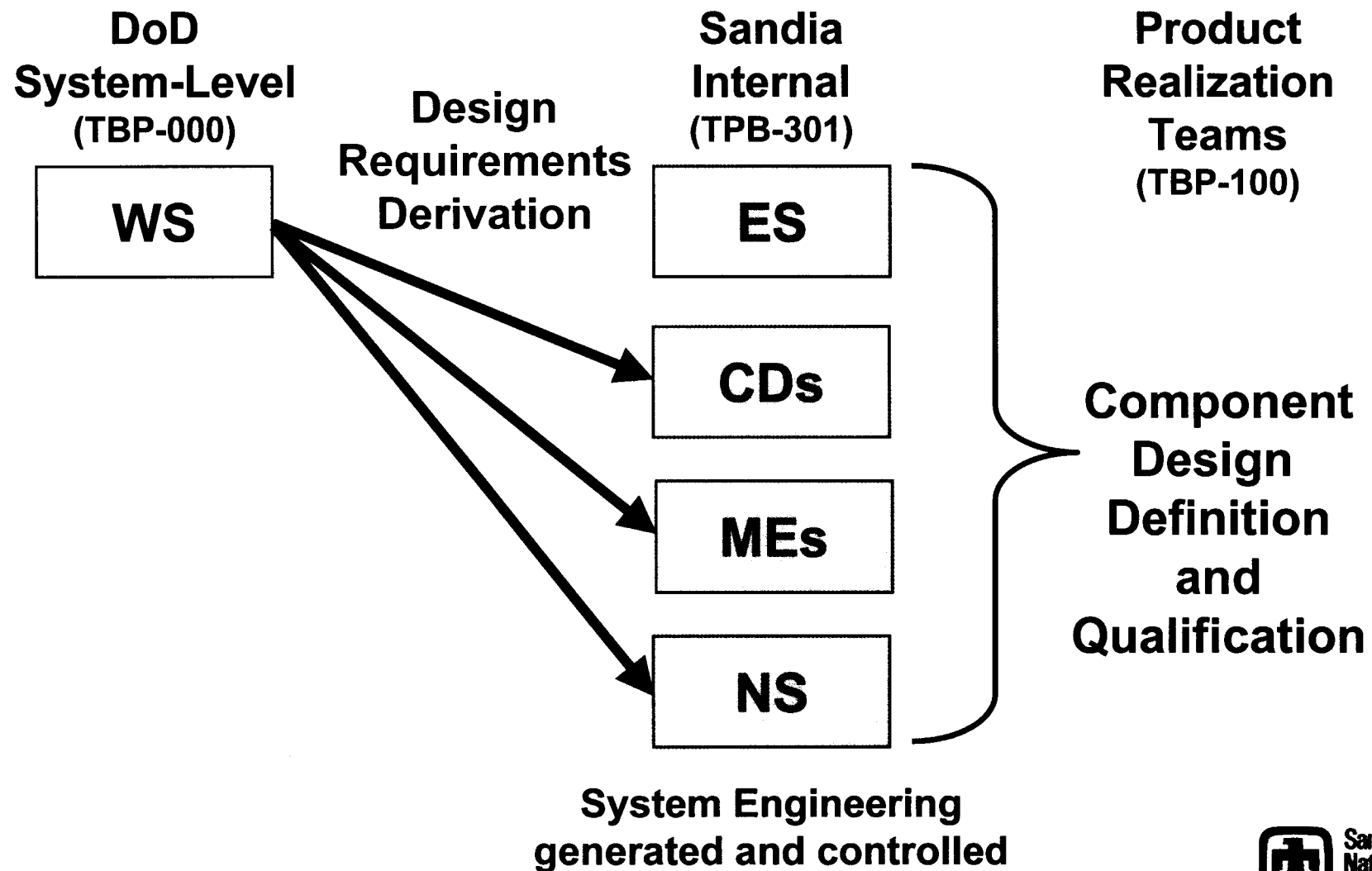


# ICDs Requirements Flow Process





# WS Requirements Flow Process







# Outline

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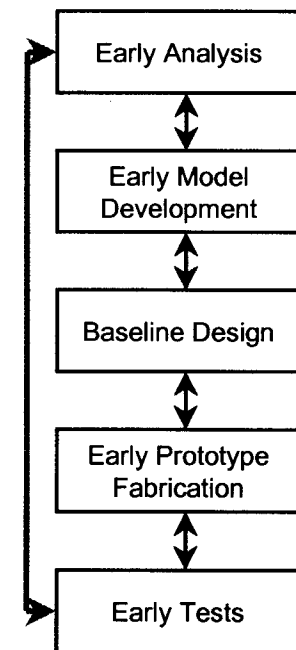
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## W76-1/Mk4A Phase 6.2/2A Validate Requirements

- The DI&C TWG validated system requirements
  - Sandia sponsored a requirements “hell week” where subject area experts submitted changes to STS and MCs for clarification and accuracy
  - Performance, schedule, and cost tradeoffs were conducted to validate requirements
  - Changes approved by the W76/Mk4 POG and incorporated into draft MCs and STS

### Early Design and Requirements Validation

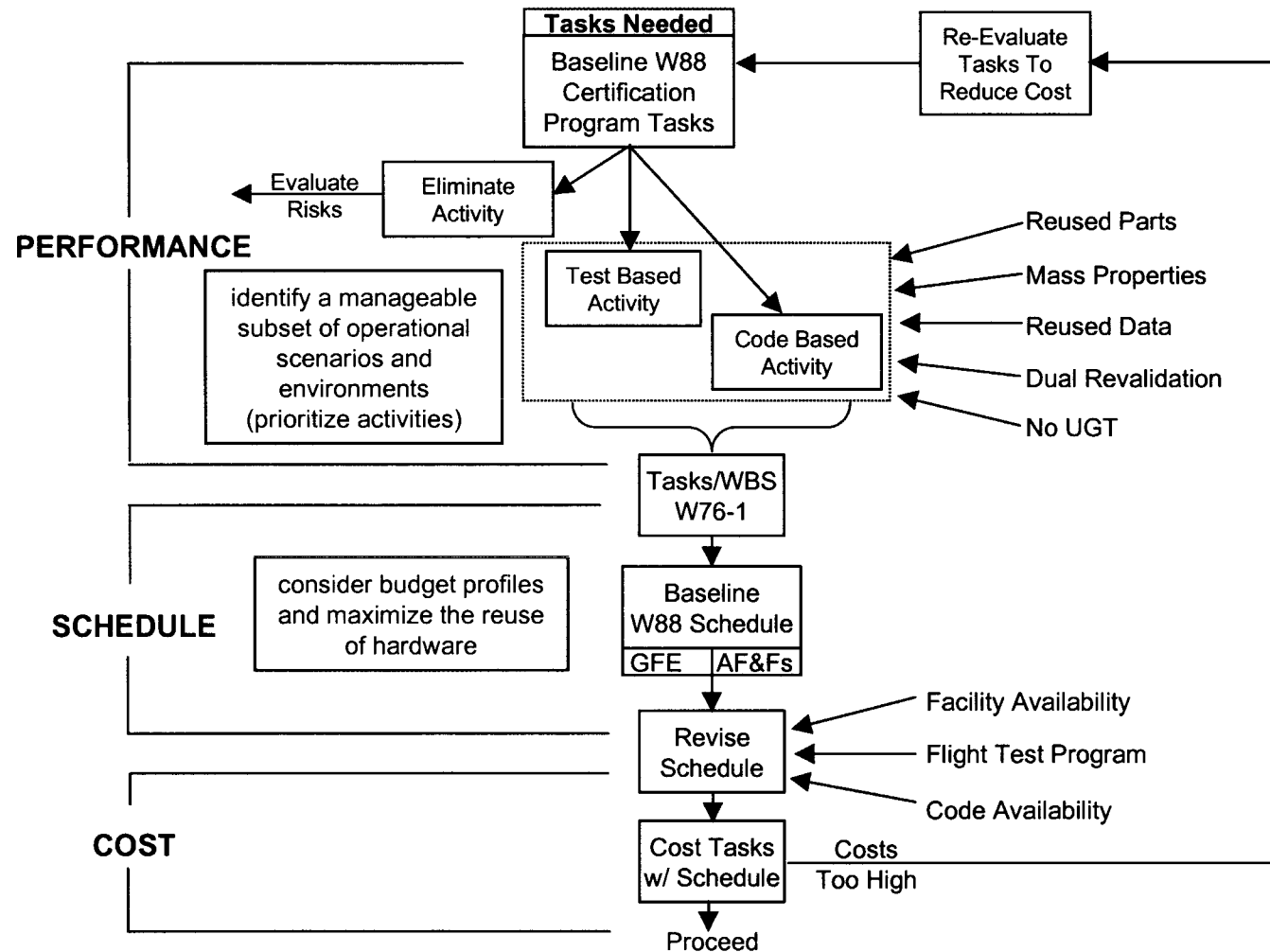


Design Can Work



# W76-1 System Qualification Plan

## Performance, Schedule, and Cost Tradeoffs



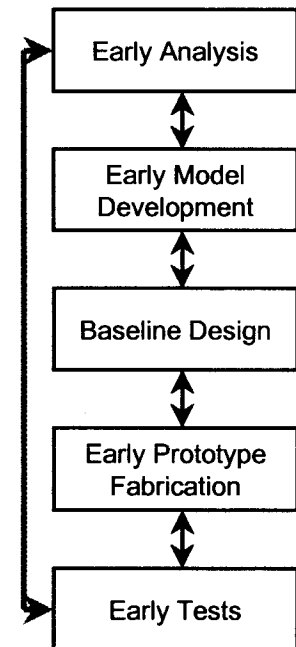


## **W76-1/Mk4A Phase 6.2/2A Validate Requirements**

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- **W76-1/Mk4A System Qualification Plan generated**
  - Flight testing, ground testing, analysis, modeling and simulation are combined to qualify the design against performance requirements
  - Qualification activities were linked directly to MCs, STS, and WS requirements
  - DI&C TWG Joint Test Subgroup reviewed and W76/Mk4 POG approved the plan

**Early Design and  
Requirements Validation**



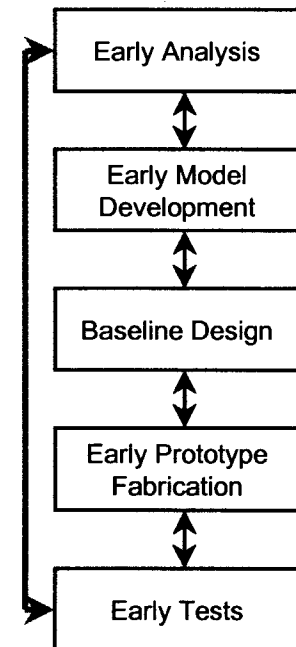
**Design Can Work**



## W76-1/Mk4A Phase 6.3 Validate Requirements

- **Technical Working Groups to validate performance requirements, interfaces, and specifications**
  - Changes will be submitted to the MC/STS TWG for incorporation into MCs, STS, ICDs, and WS
- **SNL system engineers to generate draft CD, ME, ES, and NS requirements for component and subsystem development**
  - Populating the DOORS requirements tracking tool

### Early Design and Requirements Validation



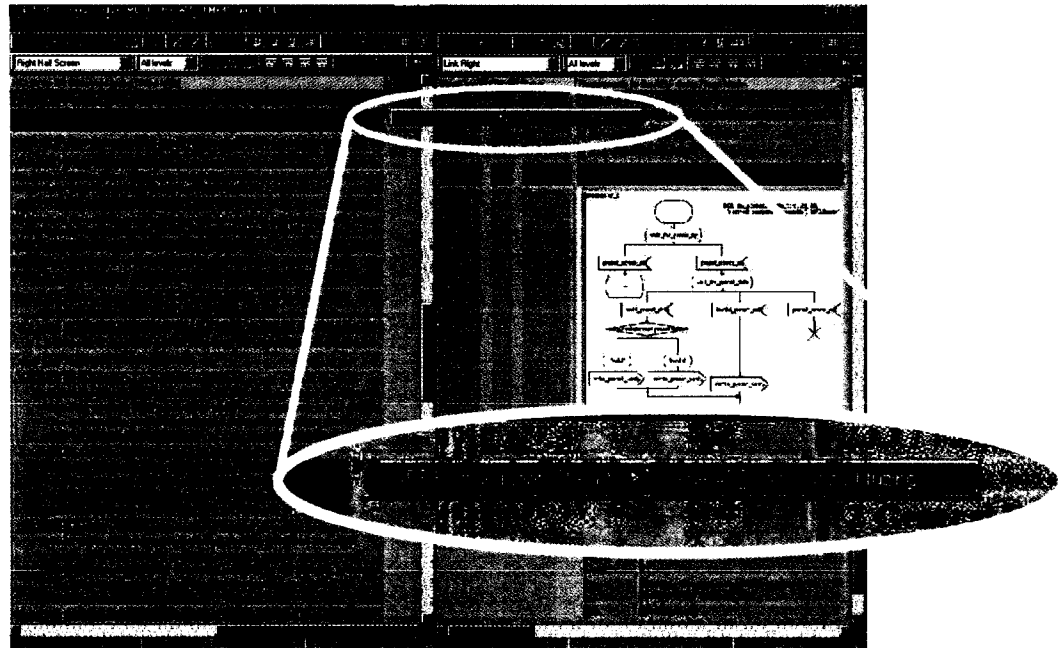
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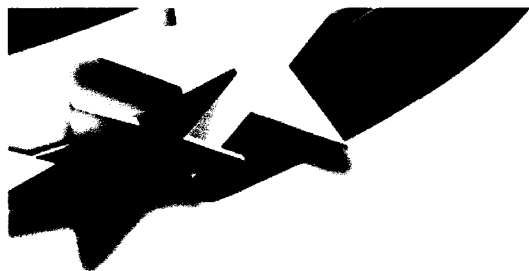
# Dynamic Object Oriented Requirements System

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- **DOORS**
  - Single system requirements database
  - Traceability to source requirements
  - Configuration management
  - Incorporate graphs and tables
  - User-friendly interface



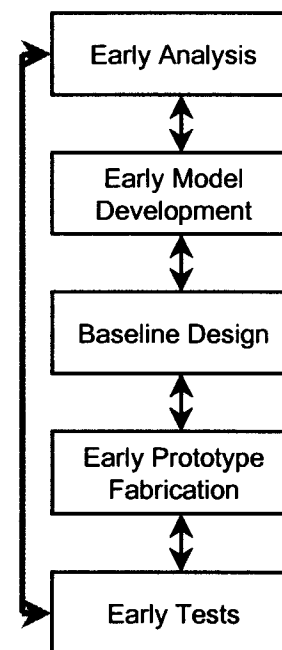
**Automated Requirements Tracking Tool**



## W76-1/Mk4A Phase 6.3 Validate Requirements

- **W76-1/Mk4A System Qualification Plan updated and revised**
  - **SQ&E TWG** will review and submit plan to **W76-1/Mk4A LEG** for approval
- **Product Realization Teams (PRTs) established (concurrent design & production engineering)**
  - **Stage I - Requirements Verification** to verify conceptual design meets customer requirements

### Early Design and Requirements Validation



Design Can Work



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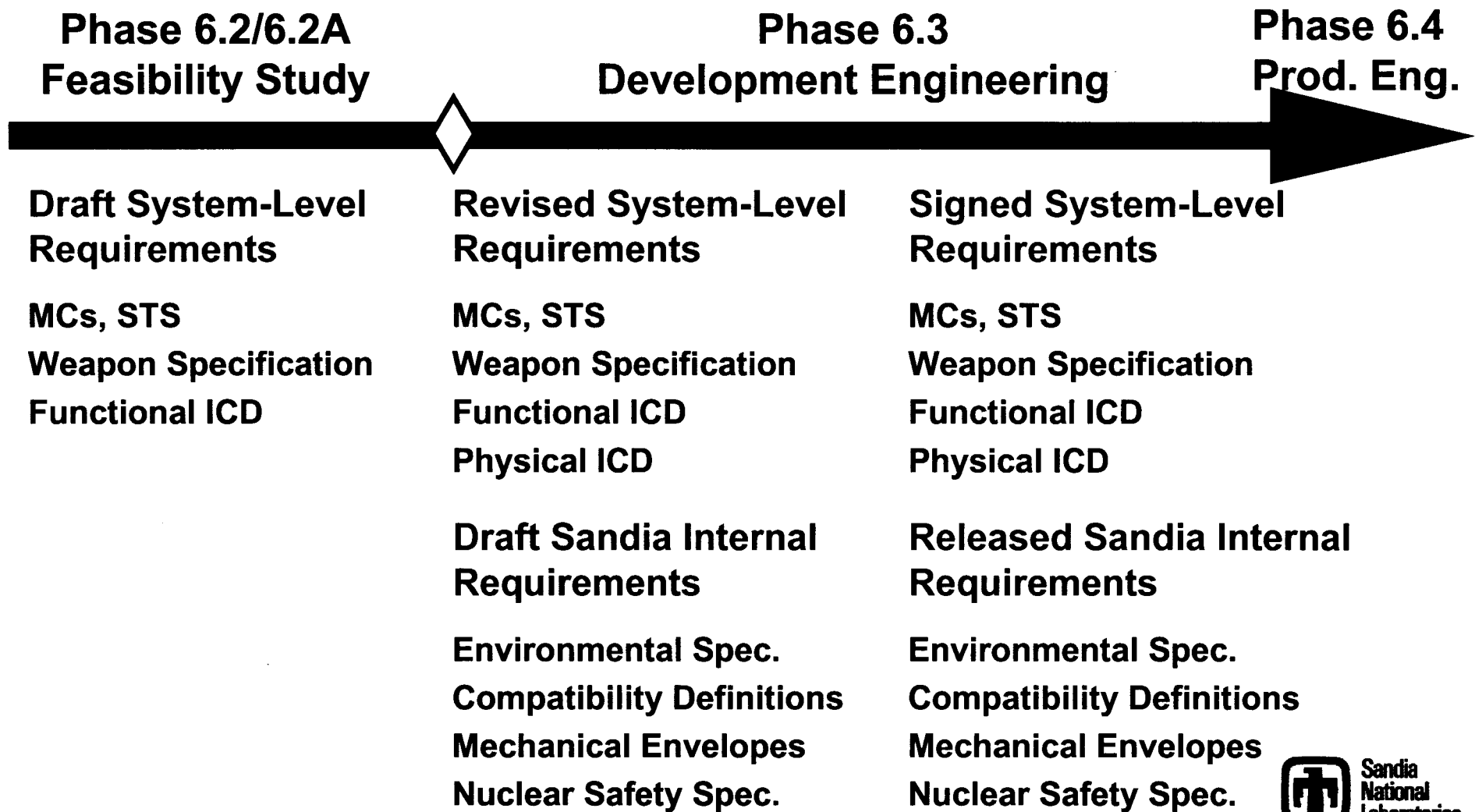
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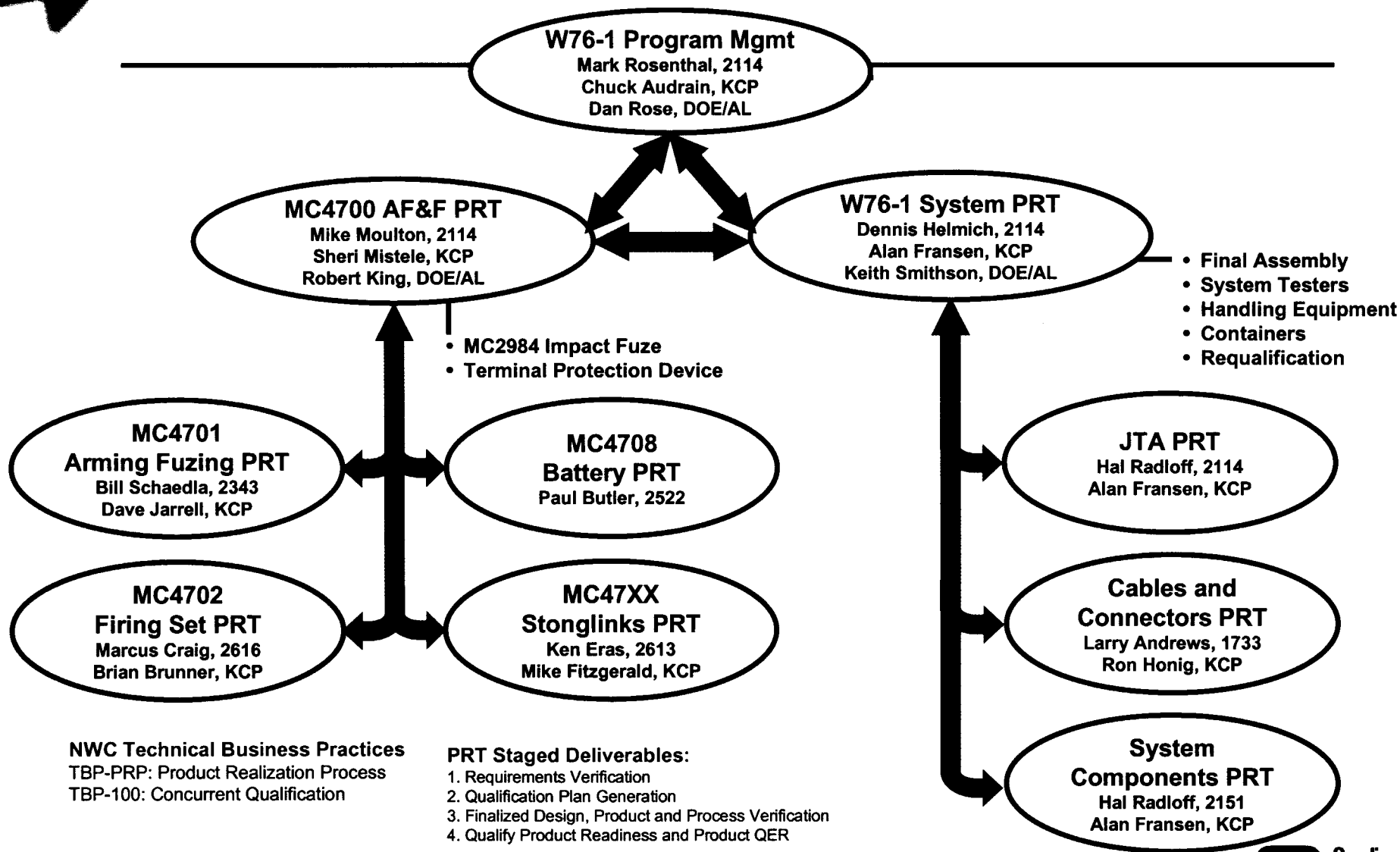


# W76-1/Mk4A Status of Performance Requirements





# W76-1 SNL/KCP PRTs Established



*Not an organizational chart*